Remarks

Reconsideration of this Application is respectfully requested. This Reply is submitted in order to present the rejected claims with their arguments in better form for consideration upon appeal. This Reply is also submitted to reintroduce a Declaration Under 37 C.F.R. § 1.132 in a form requested by the Examiner.

Claims 1, 4, and 6-7 are pending in the application, with claim 1 being the independent claim. Claim 7 was previously withdrawn from consideration. Claims 2, 3, 5, and 8 were previously cancelled.

Based on the following remarks, Applicants respectfully request that the Examiner reconsider all rejections and that they be withdrawn.

Rejections under 35 U.S.C. § 103

Claims 1, 4 and 6 were rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Galasso (U.S. Pat. No. 4,425,407) in view of Booth (U.S. Pat. No. 5,330,789), Holko (U.S. Pat. No. 5,021,107), and Hanzawa (U.S. Pub. No. 2001/005258). Specifically, the Examiner alleged that the Galasso patent teaches formation of an initial coating layer on the carbon/carbon composite by pack cementation (col. 2, ll. 64-68), and that an additional coating comprising Si powder can be applied (col. 3, ll. 53-57). The Examiner conceded that Galasso does not teach "*oxidizing Si in the Si-SiC layer.*" Office Action, pg. 3, ll. 15. Applicants respectfully wish point out that claim 1 recites "*oxidizing the Si layer* to form an SiO_2 film," not "*oxidizing Si in the Si-SiC layer*." The Examiner also conceded that Galasso does not teach heat treating at reduced pressure.

The Examiner alleged that Booth cures the deficiencies of Galasso by teaching formation of a SiO_2 to protect the SiC layer. Office Action, pg. 4, ll. 4-8. As evidence for the desire to oxidize an Si-SiC layer, the Examiner alleged "the first layer would be desireably oxidized but that a high temperature is needed, and that the second layer, with [sic] contains Si is to be oxidized as well, at the lower temperature." Office Action, pg. 9, ll. 8-11. The Examiner alleged that Hanzawa cures the deficiencies of Galasso by teaching heat treating carbon/carbon composites at reduced pressure. Office Action, pg. 5, ll. 4-14.

The Examiner's attention is directed to at least four features of the presently claimed invention which are distinct from Galasso, Booth, Holko, and Hanzawa: (1) three distinct layers, including a SiC layer, Si layer, and SiO_2 film, (2) oxidation of the Si layer to form an SiO_2 film, (3) heat treating an Si coating under low pressure to form a Si and SiC bilayer, and (4) heat treating at 1400 °C to about 1600 °C.

I. Booth does not teach three distinct layers, including an SiC layer, Si layer and SiO_2 film.

The method of claim 1 results in the formation of three distinct layers, including an SiC layer, Si layer and SiO_2 layer. Applicants note that Booth describes two different coatings: a primary coating and a secondary coating. In the primary coating of Booth, *Si is dispersed with SiC* and optionally aluminum oxide, thus forming one layer with a mixture of Si-SiC (optionally with AlO_3). Col. 3, ll. 53-68, and col. 4, ll. 19-25. The Examiner noted that "as worded, the claims do not require the Si layer to contain nothing but Si." Office Action, pg. 9, ll. 10-11. However, Applicants emphasize that claim 1

recites three distinct layers: a SiC layer, a Si layer and a SiO_2 film. It is an improper rejection to allege the one SiC-Si layer of Booth is equivalent to the bilayer containing the SiC layer and the Si layer of the present invention. The distinctive nature of the SiC layer and the Si layer is exemplified in Figure 1.

Applicants also note that a composite with three distinct layers exhibits distinct and useful properties. For example, the coefficients of thermal expansion (CTE) are known in the art, and include 4 ppm/K for SiC, 2.3 ppm/K for Si, and 0.5 ppm/K for SiO_2. See, e.g., http://www.ioffe.ru/SVA/NSM/Semicond/Si/thermal.html, http://www.siliconfareast.com/sio2si3n4.htm, and http://www.accuratus.com/silicar.html. Due to the differences in CTE, a layer containing both Si and SiC may aggravate thermal mismatch. However, the present invention overcomes thermal mismatch by using three distinct layers of SiC, Si and SiO_2.

Since neither Galasso, Booth, Holko or Hanzawa teach a method of making a composite, resulting in the formation of a composite with three distinct layers as featured in claim 1, each and every element of the claim is not taught. Claims 4 and 6 depend from claim 1. For at least the above reason, Applicants respectfully request that the rejections under 35 U.S.C. § 103(a) be withdrawn.

II. Booth does not teach, or provide a reason to oxidize an Si layer to form an SiO_2 film.

Claim 1 recites oxidizing the Si layer to form an SiO_2 film. The Examiner alleged that Booth provides the desire to oxidize the primary coating, citing Booth, col. 4, ll. 33-37, "because SiC and Si oxidize to form a wet protective film of SiO_2 . . . ." As

explained above, Booth teaches dispersing Si with SiC, and optionally aluminum oxide, to form one layer containing a mixture of Si and SiC (and optionally AlO_3). *In Booth, there is no oxidation of a Si layer to form a SiO_2 film, since a SiC/Si layer (not an Si layer) is present.*

Additionally, Booth does NOT provide a reason to oxidize an Si-SiC layer to form an SiO_2 film. According to Booth, upon formation of the first coating layer of Si/SiC, an SiO_2 layer is NOT formed at temperatures under 1600 °F (871 °C), thus the primary coating will NOT be protected by an SiO_2 layer in the 900 °F to 1600 °F range (482 °C to 871 °C range). Col. 4, ll. 35-30. To protect the primary coating, Booth provides motivation to form a second layer to protect the primary layer, the second layer "formed by mixing silicon particulates, silicon carbide particulates, and boron particulates," which provides protection at 900 °F to 1600 °F. Col. 4, ll. 55-58. This second layer, when heated produces a B_2O_3-SiO_2 layer. Col. 5, l. 44. **Thus, Booth provides motivation to add a layer comprising B/Si/SiC to protect his composite, not a SiO_2 film.**

Since neither Galasso, Booth, Holko or Hanzawa teach, or provide a reason, to oxidize an Si layer to form an SiO_2 film as featured in claim 1, each and every element of the claim is not taught. Claims 4 and 6 depend from claim 1. For at least the above reason, Applicants respectfully request that the rejections under 35 U.S.C. § 103(a) be withdrawn.

III. Hanzawa does not teach heat treating an Si coating under low pressure to form a Si and SiC bilayer.

Claim 1 features heat treating the Si-coated composite under a pressure of about 10 mTorr to about 1000 mTorr. The Examiner acknowledged that neither Galasso nor Booth teach heat treating under a pressure of about 10 mTorr to about 1000 mTorr. However, the Examiner alleged that Hanzawa cures the deficiencies of Galasso and Booth. Specifically, the Examiner alleged that Hanzawa "provides that Si material can be heated at a final temperature of 1450-2500 degrees C at 0.1 to 10hPa (75-7500 mTorr) to melt the silicon to impregnate the carbon/carbon composite to form Si/SiC." Office Action, pg. 5, ll. 4-6.

The Examiner's attention is directed to the entirety of Hanzawa. Hanzawa discloses placing "carbon/carbon composites" in a "carbon crucible filled with Si powder." See [0112]. This crucible is then heated under low pressure (0.1 - 10 hPa, i.e., 75-7500 mTorr), which is a much larger range of pressures than the pressures featured in claim 1 (10-1000 mTorr). The process of Hanzawa results in a composite material wherein "the content rate of silicon becomes higher according to the distance from the surface of the [composite] yarn." See [0033]. **In other words, the low pressure process of Hanzawa results in a composition having a Si/SiC gradient, not a bilayer coat as is featured in claim 1.** The Examiner previously acknowledged that the process of Hanzawa was distinct from the present invention. See, e.g., Office Action of February 11, 2008, pg. 6, 2nd ¶.

Claim 1 features heat treating Si-coated carbon/carbon composites, wherein the Si coating was achieved by spraying on a mixture comprising vehicle liquid and Si powder. Applicants found that for spray coated composites, the increased temperatures during heat treating reduced the viscosity of Si, but also induced increased oxidation and

thermal mismatch. These problems for the spray coated composites were overcome by lowering the pressure (about 10 to about 1000 mTorr) during the heat treating. By lowering the pressure, Applicants found that a lower melting point was achieved which allowed the heat treating to occur at a lower temperature, thereby reducing the problems of oxidation and thermal mismatch. Additionally, this method resulted in carbon/carbon composites having an initial layer being coated with a bilayer comprising an SiC layer and an Si layer.

Since neither Galasso, Booth, Holko or Hanzawa teach, or provide a reason, to heat treat spray coated composites under low pressure to form bilayer coatings, then each and every element of the claim is not taught. Claims 4 and 6 depend from claim 1. For at least the above reason, Applicants respectfully request that the rejections under 35 U.S.C. § 103(a) be withdrawn.

IV. The temperature range of 1400 °C to about 1600 °C is not anticipated by the cited documents.

Claim 1 features heat treating at 1400 °C to about 1600 °C. Applicants previously submitted a Declaration by the inventors for consideration by the Examiner. The Examiner has alleged that the Declaration was insufficient because it did not set forth "in the body of the declaration that all statements are made of the declarant's own knowledge are true and that all statements made on information and belief are believed to be true." Office Action, pg. 8, ll. 1-10. Applicants respectfully disagree that the previous Declaration's statement was insufficient. However, solely to expedite

prosecution, Applicants hereby submit a newly executed Declaration Under 37 C.F.R. § 1.132 which contains the language requested by the Examiner.

In the resubmitted Declaration, Applicants have demonstrated the critical nature of the temperature range as found in amended claim 1. Specifically, Applicants have demonstrated that a heat treating temperature of about 1400 °C is sufficient to promote the uniform coating of Si on the carbon/carbon composites. See, e.g., Figs. 2 and 3 of the Declaration. Temperatures lower than 1400 °C are insufficient to melt the Si particles to uniformly cover the composites. See, e.g., Fig. 1 of the Declaration. Temperatures above 1600 °C are less economical due to the costs associated with increased temperatures.

The Examiner alleged that the ***cost savings*** associated with the upper limit of 1600 °C was not unexpected. Office Action pg. 8, ll. 9-11. Applicants wish to stress that the ***effectiveness of the method below the upper limit***, (*i.e.*, 1600 °C) is unexpected, rather than the cost savings being unexpected. This unexpected benefit of the upper temperature range limit is beneficial due to the reduced costs associated with the range.

The Examiner also noted that the lower claimed temperature limit (1400 °C) is lower than the temperature in the Declaration (1412 °C). It is unclear what the Examiner's rejection is with this regard. Applicants do not have to demonstrate data for each metric within a range. If the Examiner is proposing that the claimed temperature range contains inoperable embodiments (e.g., the use of temperatures from 1400-1412 °C), and is thus not enabled, then Applicants traverse this rejection. Even if the range of 1400-1412 °C did contain some inoperable embodiments, it is well established

that a claim may encompass some inoperable embodiments. See, e.g., *Crown Operations, International Ltd. v. Solutia Inc.*, 289 F.3d. 1367 (Fed. Cir. 2002).

The Examiner alleged that Hanzawa provides a "bottom limit of 1450 for the melt silicon step." Office Action, pg. 8, ll. 13-15. In actuality, Hanzawa disclosed the use of a temperature range of 1450-2500 °C. As noted in Applicants' Reply of June 11, 2008, even if there is overlap of range, no reasonable fact finder can determine that the overlap described the entire claimed range with sufficient specificity to anticipate the range recited in the claim. See, *Atofina v. Great Lakes Chemical Corp.*, 441 F.3d 991, 993 (Fed. Cir. 2006). The range cited by Hanzawa did not describe the unexpected lower limit of 1400 °C, nor did it appreciate the benefits of the upper limit of 1600 °C. For at least the above reason, Applicants respectfully request that the rejections under 35 U.S.C. § 103(a) be withdrawn.

Other Matters

Claims 1, 4 and 6 were provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 1, 4 and 6 of copending U.S. Appl. No. 10/767,858 in view of Galasso.

The final constitution of any allowed claims in either application is unknown. Therefore, it is Applicants' position that a terminal disclaimer would be premature at this time, *since a terminal disclaimer may not be required if claims are changed substantially*. **However, upon allowance of either application, Applicants request the Examiner contact Applicants' representatives, and Applicants will consider submitting a terminal disclaimer if required based on the allowed claims.**

Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.

Scott M. Woodhouse
Agent for Applicants
Registration No. 54,747

Date: NOVEMBER 12, 2008

1100 New York Avenue, N.W.
Washington, D.C. 20005-3934
(202) 371-2600

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